Corneal disease is common in both dogs and cats and can be primary or secondary to other ophthalmic or systemic disease. Corneal disease may result in opacification, vascularization, pain, ulceration, pigmentation, or perforation. Owners will often present animals early in the course of corneal disease as the clinical signs of epiphora, blepharospasm, photophobia, pawing, and opacification are readily apparent. Despite this, corneal disease may progress rapidly and be advanced at the time of presentation, requiring immediate and aggressive medical or surgical intervention.

When presented with ulcerative keratitis, the clinician must, if possible, identify the etiology and, if the cause is still present, eliminate it. This would include foreign bodies, eyelid positional abnormalities, abnormal hairs, blink and tear abnormalities, and infectious causes. A complete ophthalmic examination and possibly corneal cytology and culture are indicated.

Corneal ulcers should be classified according to depth, size, etiology, presence or absence of infection, and collagenase activity. Culture and sensitivity, Schirmer tear test (STT), cytology, fluorescein stain retention, and complete anterior segment examination should be considered as part of a routine examination in animals with a corneal ulcer. Most corneal ulcers are superficial and heal rapidly without complication. Medical therapy will prevent or eliminate infection, alleviate discomfort, and facilitate healing. Surgical therapy should be considered for a stromal abscess or ulcers that fail to heal, worsen despite treatment, or are deep or melting at initial presentation. Descemetocoeles and perforated corneal ulcers are considered surgical emergencies. The surgical treatment of choice varies according to the size and depth of the corneal defect.

Medical therapy for ulcerative keratitis may include topical application of artificial tears, broad-spectrum antibiotics, mydriatic-cycloplegics, and anti-inflammatory/immune-modulating drugs such as nonsteroidal anti-inflammatory drugs (NSAIDs) and cyclosporin. The antibiotic of choice will often depend on the severity of the disease, cytology and culture results, cost, and clinician preference. Systemic medications are of limited value for treatment of nonpenetrating corneal disease but are occasionally used to supplement topical therapy. The frequency of administration of topical medications varies according to the severity of the disease, ranging from every 2 hours to every 8 hours. When multiple topical medications are administered, solutions should be administered before ointments, and medications should be spaced 5 minutes apart.

Surgical management of corneal disease ranges from a superficial linear keratotomy/diamond burr for refractory indolent ulcers to corneal transplantation for repair of full-thickness defects or restoration of endothelial cell function. The ophthalmic surgeon should be fully versed in microsurgical techniques and utilize appropriate surgical instrumentation, suture material, and magnification to maximize the opportunity for a successful outcome. In addition, the clinician must be familiar with corneal anatomy and physiology and with specific adjunctive medical therapy, as indicated by the inciting cause and the surgical procedure performed.

Prior to surgical correction of corneal disease, a complete ophthalmic examination is essential. The presence of associate or exacerbating adnexal or intraocular disease should be identified and managed prior to or at the time of corneal surgery. Failure to correct problems such as blepharitis, entropion, keratoconjunctivitis sicca (KCS), distichia, or other adnexal abnormalities may result in failure of corneal surgery, regardless of how well it is performed.

For corneal surgery, the animal must be under general anesthesia. For more involved corneal surgery, use of a nondepolarizing neuromuscular blocking agent intravenously may be required. If needed, one or more stay sutures, placed in the episclera at the inferior-medial aspect of the globe, can be used to rotate the globe up while rotating the third eyelid down. Head positioning is essential. The animal is placed in lateral or dorsal recumbency and the head positioned such that the cornea is parallel with the table and the eye looking toward the ceiling. A vacuum pillow (Olympic Vac-Pac, Olympic Medical, Seattle) will facilitate this positioning and ensure immobilization during surgery. An eyelid speculum is used to retract the eyelids and provide exposure. If greater exposure of the cornea is required, a lateral canthotomy can be performed to enlarge the palpebral fissure. Following completion of the corneal surgery, the canthotomy is closed in a two-layer fashion. Magnification in the form of surgical loupes will facilitate precise incisions, delicate tissue handling, and accurate wound closure. Appropriate magnification for corneal procedures ranges from 2.5x to 10x. Surgical loupes are less expensive and may provide adequate...
diamond burr has been shown to be a safe and highly effective technique in the management of indolent ulceration. Cutting tool. Alternately, a diamond burr may be used to gently debride the exposed basement membrane. The epithelial cells. Next, a linear or grid keratotomy is performed using the beveled edge of a 27-gauge needle as a cutting tool. Alternately, a diamond burr may be used to gently debride the exposed basement membrane. The diamond burr has been shown to be a safe and highly effective technique in the management of indolent ulceration. Refractory epithelial erosions also termed “boxer ulcer,” indolent ulcers, or persistent/recurrent erosions, are characterized by their superficial nature, chronicity, and loose redundant epithelium at the ulcer margin, and often a delayed vascular response and minimal pain, as compared with typical superficial ulcers. Older dogs and certain breeds, such as the boxer, golden retriever, corgi, and miniature poodle, appear predisposed, but dogs of any age or sex can be affected. Refractory epithelial erosions occur as a result of a primary disorder in the adhesion between the basal epithelium of the cornea and its basement membrane.

Once a diagnosis of a refractory epithelial erosion is made, there are several steps that will facilitate healing. First, the loose epithelium is mechanically debrided following application of topical 0.5% proparacaine. A dry, sterile, cotton-tipped applicator or forceps are used to roll the epithelial margin back, peeling off all loose and nonattached epithelial cells. Next, a linear or grid keratotomy is performed using the beveled edge of a 27-gauge needle as a cutting tool. Alternately, a diamond burr may be used to gently debride the exposed basement membrane. The diamond burr has been shown to be a safe and highly effective technique in the management of indolent ulceration. Topical tetracycline has also been shown to significantly decrease time to healing, and corneal contact lenses have been shown to improve patient comfort and may also facilitate healing.

**Keratectomy**

A keratectomy involves excision of the corneal epithelium and a portion of the underlying stroma. Indications include corneal dermoid, feline corneal sequestrum, indolent ulceration, corneal neoplasia (excision or biopsy), debridement of infectious keratitis prior to performing a grafting procedure, pigmentary keratitis, corneal crystalline degeneration with secondary ulcerative or nonulcerative keratitis, lamellar keratoplasty, and other diseases requiring removal of the outer portion of the corneal stroma. In general, up to one-third of the corneal stromal depth can be removed and allowed to heal by primary intention. If the excision equals or exceeds half of the corneal stromal depth, a grafting procedure such as a conjunctival pedicle graft or lamellar keratoplasty is indicated.

In addition to a routine microsurgical pack, specific instrumentation for a superficial keratectomy includes a #64 Beaver blade and/or a Martinez corneal dissector. The abnormal portion of the cornea to be excised is outlined using a #64 Beaver blade. If a conjunctival graft is planned, I find a square or rectangular incision with straight sides easier to suture a graft into as compared with a circular defect. The depth of the incision should be sufficient to remove the lesion. Once the area to be excised has been outlined, the edge is grasped with 0.12 mm colibri forceps. The edge is gently elevated, and with a Martinez corneal dissector or #64 Beaver blade, the corneal lamellae are separated. Care is taken to remain within the same lamellar plane using blunt rather than sharp dissection. Avoiding tension on the portion of cornea to be excised and moving the blade or dissector back and forth exerting only gentle pressure will facilitate maintaining a constant incisional depth. When completely dissected, the excision can be completed with the blade or tenotomy scissors. The cornea is kept moist during the procedure. If the diseased portion of cornea is vascularized, topical 1:10,000 epinephrine will aid in hemostasis. The excised portion of cornea should be submitted for histopathology or culture as indicated. If more than half of the stromal depth has been excised, a conjunctival pedicle graft or lamellar keratoplasty is indicated to provide support and facilitate healing.

**Conjunctival Grafts**

 Conjunctival autografts are readily available in both dogs and cats and originate from the bulbar conjunctiva. These are used to strength weakened corneal stroma and serve to provide fibroblasts, blood vessels, and epithelial cells that repair defects and offer antimicrobial and antiprotease/anticollagenase properties. Indications for conjunctival grafts include deep, nonperforating corneal ulcers that have failed to respond to medical therapy following excision of a feline corneal sequestrum, descemetoceles, mycotic keratitis, bullous keratopathy, recurrent erosions, stromal abscessation, and keratomalacia. Perforating corneal defects with or without iris prolapse are better managed using lamellar or penetrating keratoplasty. Conjunctival grafts have been described in a variety of patterns, but the rotational bulbar pedicle graft is the optimal conjunctival graft for the small animal cornea. Rotational grafts allow the animal to see around the graft and the veterinarian to evaluate intraocular structures following surgical repair. In addition, assessment of corneal health and pupil dilation are easily performed with a pedicle graft, and topical drug penetration is not inhibited. Lastly, the aim of a graft is to cover the defect, but only the defect, achieving
conjunctival to corneal epithelial cell apposition over as much of the graft circumference as possible. A pedicle graft allows edge-to-edge apposition over at least 270 degrees of the graft margin and will ensure rapid acceptance of the graft, epithelial cell contact inhibition, and cell-to-cell adherence and minimize scar formation. Failure to achieve donor-to-recipient wound-edge apposition results in epithelial cell migration and proliferation until cell contact inhibition occurs. Epithelial cells may migrate along the underside of the graft, interfering with graft attachment to corneal stroma, and ultimately, graft failure. It is for this reason that conjunctival flaps should fit the corneal defect as closely as possible and not simply be pulled over the defect.

Prior to performing a pedicle conjunctival graft, the recipient site must be prepared. This involves a keratectomy to debride malacic, necrotic, or infected corneal stroma from the ulcer and surrounding cornea. Following preparation of the recipient site, a donor pedicle is harvested from the bulbar conjunctiva. Bulbar conjunctival pedicle grafts are most easily harvested from the superior-temporal quadrant, taking care to avoid the inferior-nasal quadrant and the nictitans. Other considerations when selecting a donor site are ease of surgical access, presence of pigmentation, and proximity to the recipient site. In general, grafts should travel the shortest distance, be oriented dorsoventral on the cornea, originate from the most accessible site, and not contain pigment, if a transparent cornea is the end goal. Grafts with pigmentation will, however, offer a more cosmetic scar in the canine eye, as most dog eyes appear dark on initial assessment and a pigmented corneal scar is less apparent. The donor conjunctiva is harvested using colibri forceps and curved blunt-tipped Stevens tenotomy scissors. The conjunctiva is elevated 1 to 2 mm posterior to the limbus and incised. The tips of the tenotomy scissors are inserted and curve upward through the conjunctival defect, and the bulbar conjunctiva is bluntly dissected from the underlying Tenon’s and episcleral tissues. Care is taken to ensure that the graft remains as thin as possible without perforating the conjunctiva. The graft is then incised from the limbus with an incision parallel to and 1 mm posterior to the limbus. The next incision is at the tip of the graft and is made at 90 degrees to the first incision and toward the fornix. This cut should be 1 to 2 mm longer than the width of the recipient bed. The final incision is made parallel to the first, taking care not to allow the graft to become thinner at the base than at the tip. The graft is then rotated using 2 forceps onto the cornea and placed over the recipient site. The graft should not retract from the recipient bed. If it does, the graft is made longer by extending the two incisions parallel to the limbus. The graft should also not be too long, as this will make it loose and too mobile. Excessive graft material should be trimmed and discarded. The distal two corners of the graft are sutured first, followed by the proximal two corners. These are usually simple interrupted sutures and should be placed through the graft and then into the angle at the base of the keratectomy. Suture material will vary according to surgeon’s preference and equipment available. In general, 7-0 absorbable is used if only surgical loupes are available, and 8-0 or 9-0 absorbable or nonabsorbable can be used if an operating microscope is available. Absorbable sutures, such as polygalactin 910 or polyglycolic acid, are appropriate. The remainder of the graft can be sutured with interrupted, simple continuous, or a double saw-toothed continuous pattern, with the intention being graft immobility and excellent donor-to-recipient apposition. Toward this goal, my preference is a double saw-toothed continuous pattern using 8-0 to 9-0 polygalactin 910.

References